

REMARKS

Claims 1, 3-10, 21, 23, 25 and 27-30 are pending. By this Amendment, Claim 21 has been amended. Claim 21 has been rewritten in independent form including the combinations of features of Claims 1 and 21. Accordingly, the amendments to Claim 21 do not raise any new issue that would require further consideration and/or search; do not raise the issue of new matter; place the application in better condition for appeal; and do not present any additional claims. Therefore, the amendments should be entered. Reconsideration of the May 20, 2003 Official Action is respectfully requested.

1. Rejection Under 35 U.S.C. § 112, First Paragraph

Claims 1, 3-10, 21, 23, 25 and 27-29 stand rejected under 35 U.S.C. §112, first paragraph. The reasons for the rejection are stated at page 2 of the Official Action. The rejection is respectfully traversed.

Claim 1 recites the feature of "the electrode having a thickness of about 0.3 inch to 0.5 inch." The Official Action asserts that the specification fails to provide support for a silicon electrode having a thickness of about 0.3 inches to 0.5 inches. Applicants respectfully disagree with this assertion for the reasons set forth in the Request for Reconsideration filed on March 17, 2003.

The Official Action further asserts at page 16, first paragraph, that "the specification, as originally filed, fails to identify with 'detailed particularity' that the electrode thickness is being incorporated by reference from the Degner et al. reference (note from page 6, lines 26-29 of the instant application only specific mention of

incorporating metallurgical or adhesive bonding of an electrode to a support from the Degner et al. reference)" This assertion also is improper for the following reasons.

U.S. Patent No. 5,074,456 to Degner et al. ("Degner") is described in the specification at several locations. At page 1, lines 8-17, the specification states that "[e]lectrodes used in plasma processing reactors for processing semiconductor substrates such as silicon wafers are disclosed in U.S. Patent Nos. 5,074,456 and 5,569,356, *the disclosures of which are hereby incorporated by reference*" (emphasis added). At page 6, lines 26-29, the specification states that "alternatively, the electrode can be metallurgically or adhesively bonded to a support by any suitable technique such as that described in commonly owned U.S. Patent No. 5,074,456 to Degner et al., *the disclosure of which is hereby incorporated by reference*" (emphasis added). Applicants respectfully submit that these statements do in fact identify with detailed particularity both the specific location of the incorporated material, i.e., in Degner, and the specific material that is incorporated, i.e., the *disclosure* of Degner. Applicants further submit that the *disclosure* of Degner that has been incorporated by reference in the specification is the *entire disclosure* of Degner.

The issue of incorporation by reference was addressed by the Court of Appeals for the Federal Circuit in *Ultradent Products Inc. v. Life-Like Cosmetics Inc.*, 44 USPQ2d 1336 (Fed. Cir. 1997) (copy attached). In *Ultradent Products*, the court considered the scope of the disclosure of U.S. Patent No. 4,990,089 to Munro ("Munro") (copy attached) and, more particularly, what part of the entire contents of U.S. Patent No. 3,657,413 to Rosenthal ("Rosenthal") had been incorporated by reference in Munro's specification by the following statement in Munro:

The commercial product PROXIGEL, described in U.S. Pat. No. 3,657,413 issued on Apr. 18, 1972 to M. W. Rosenthal, *which patent is hereby incorporated herein by reference*" (Emphasis added; col. 2, lines 10-15.)

The Federal Circuit concluded that:

The Munro patent incorporates by reference *the entire contents of the Rosenthal disclosure*. Ultradent's assertion that Munro 'says nothing' about the Rosenthal compositions and merely discloses using the commercial embodiment of the Rosenthal patent is contrary to the rules of practice, which permit incorporation of prior art by reference. (Emphasis added; citations omitted.)

Ultradent Products at 44 USPQ2d 1139.

That is, the Federal Circuit decided that the phrase "which patent is hereby incorporated by reference" has the effect of incorporating *the entire contents* of the patent in the referencing patent. The court refuted the argument that only the portion of the contents of the incorporated patent that is *specifically referred to* in the referencing patent is incorporated by reference therein.

The assertion in the Official Action that the entire disclosure of Degner has not been incorporated by reference in the specification also is in direct conflict with the patent examining procedures set forth in MPEP §201.06(c), page 200-37 (Rev. 1, Feb. 2003), which states that a prior application may be incorporated by reference into another application by including in the referencing application "a statement that such specifically enumerated prior application or applications are 'hereby incorporated herein by reference'." The statements in the specification that "the disclosure of which is hereby incorporated by reference" are substantially equivalent to the statement recommended in

MPEP §201.06(c). Thus, it is submitted that the statements in the specification are effective to incorporate the *entire contents* of Degner in the specification.

The Official Action cites the cases *Advanced Display Systems Inc. v. Kent State University*, 54 USPQ2d 1673 (Fed. Cir. 2000); *In re Seversky*, 177 USPQ 144, 146 (CCPA 1973); and *In re Sanders*, 170 USPQ 213 (CCPA 1971) as allegedly supporting the rejection. None of these cases, however, addressed the specific issue that was decided by the Federal Circuit in *Ultradent Products* and also is covered by MPEP §201.06(c); i.e., whether the statement "which patent is hereby incorporated by reference" is effective to incorporate the entire contents of a referenced document into a patent. Moreover, the specification does identify with detailed particularity both the specific location of the incorporated material, and the specific material that it incorporates.

For the foregoing reasons, Applicants submit that the *entire contents* of Degner have been incorporated by reference in the present specification. Thus, it is respectfully submitted that the specification provides a written description of the subject matter recited in Claim 1 that complies with 35 U.S.C. §112, first paragraph. Withdrawal of the rejection is therefore respectfully requested.

2. Rejection of Claims 1, 4-10, 21, 23, 25, and 27-30 Under 35 U.S.C. §103

Claims 1, 4-10, 21, 23, 25, and 27-30 stand rejected under 35 U.S.C. §103(a) over Degner in view of JP 2-20018 ("Murai"). The reasons for the rejection are stated at pages 3-5 of the Official Action. The rejection is respectfully traversed.

Claim 1 recites a low resistivity silicon electrode, which comprises "a silicon electrode comprising a showerhead electrode having a plurality of gas outlets arranged to

distribute process gas in the plasma reaction chamber during use of the showerhead electrode, *the electrode having a thickness of about 0.3 inch to 0.5 inch and an electrical resistivity of less than 1 ohm-cm*, ... the surface being exposed to plasma in the plasma reaction chamber during use of the electrode" (emphasis added).

The Official Action acknowledges that Degner does not disclose or suggest that the electrode 12 is a single crystal silicon electrode having an electrical resistivity of less than 0.05 ohm-cm, as recited in Claim 1. However, it is alleged that Murai discloses a single crystal silicon electrode having an electrical resistivity of less than 0.05 ohm-cm, and that it would have been obvious to modify Degner's apparatus to include an electrode having an electrical resistivity of less than 0.05 ohm-cm. Applicants respectfully disagree with these assertions.

Degner discloses that "the thickness and other dimensions of the electrode plate *are not critical* and will be selected based on the dimensions of the reactor, cost of the material, machinability of the material, material erosion rate, and the like" (col. 4, lines 21-25). Degner fails to disclose or suggest any advantage that might be achieved by selecting any particular electrode plate thickness within the disclosed broad range of 0.04-0.79 inch.

Murai also does not disclose or suggest an electrode thickness of about 0.3 inch to 0.5 inch. In fact, Murai is silent regarding the thickness of the electrode, and thus provides no suggestion to select the particular thickness of Degner's electrode plate of about 0.3 inch to 0.5 inch, and then to modify Degner's electrode plate having that thickness to have an electrical resistivity of less than 1 ohm-cm, as recited in Claim 1.

As Degner and Saito fail to provide the required suggestion or motivation to modify Degner, the Official Action has not established a *prima facie* case of obviousness regarding the low resistivity, silicon electrode recited in Claim 1. *See* MPEP §2143.

3. **The Claimed Subject Matter Provides Unexpected Superiority Over the Prior Art**

Applicants have attached a Declaration Under 37 C.F.R. §1.132 by Jerome S. Hubacek, one of the inventors of the claimed subject matter. The Rule 132 Declaration explains the unexpected superiority of the claimed subject matter as compared to the prior art. More particularly, the Rule 132 Declaration explains that the claimed low resistivity, silicon electrode provides (a) a reduced center-to-edge temperature gradient; (b) an increased lifetime; (c) reduced byproduct deposition behind the electrode; and (d) reduced electrical resistance.

The Rule 132 Declaration should be considered consistent with the following principles. First, it is well-established that the claimed invention must be compared to the closest prior art. *See, In re Baxter*, 21 USPQ2d 1281, 1285 (Fed. Cir. 1991), and MPEP §716.02(e). It is improper to require Applicants to compare claimed subject matter with subject matter resulting from a combination of references applied under 35 U.S.C. §103, as this "would be requiring comparison of the results of the invention with the results of the invention." *In re Chapman*, 148 USPQ 711, 714, (CCPA 1966); MPEP §716.02(f).

Second, "evidence and arguments directed to advantages not disclosed in the specification cannot be disregarded." *See* MPEP §716.02(f).

a. **Reduction of Center-to-Edge Temperature Gradient of Electrode**

As explained in the Rule 132 Declaration, low resistivity, single crystal silicon showerhead electrodes were tested in a plasma reaction chamber. The showerhead electrodes included a plurality of gas outlets with a diameter of 0.025 inch arranged to distribute a process gas in the reaction chamber during use of the electrodes. The showerhead electrodes had thicknesses of 0.15 inch, 0.18 inch, 0.25 inch, and 0.35 inch, and were bonded to a graphite support member by an elastomeric joint.

Power levels of 1000 watts, 2000 watts, and 3000 watts were applied to each of the showerhead electrodes, and additionally a power level of 4000 watts was applied to the showerhead electrodes having a thickness of 0.25 inch and 0.35 inch. The center-to-edge temperature gradients of the showerhead electrodes having a thickness of 0.15 inch, 0.18 inch, and 0.35 inch were modeled based on temperature measurements made for the 0.25 inch thick electrode.

The comparative test data are plotted in the graph in Appendix A attached to the Rule 132 Declaration. The graph shows that *at each applied power level*, the center-to-edge temperature gradient decreased as the showerhead electrode thickness increased. For example, at a power level of 3000 watts, increasing the electrode thickness from 0.25 inch (which falls outside the electrode thickness range of 0.3 to 0.5 inch recited in Claim 1) to 0.30 inch reduces the center-to-edge temperature gradient by about 15% (based on the centigrade temperature scale), and increasing the electrode thickness from 0.25 inch to 0.35 inch reduces the center-to-edge temperature gradient by about 35%. This result is described at page 13, lines 15-19, of the specification. Reducing the temperature gradient

surprisingly reduces the probability of cracking of the electrode, especially at high power levels, such as 4000 watts.

Degner fails to disclose or suggest that an electrode thickness of 0.3 to 0.5 inch reduces the center-to-edge temperature gradient of the electrode as compared to electrode thicknesses below the recited range, or that this result reduces the probability of electrode cracking.

b. Improvement of Showerhead Electrode Lifetime

The Rule 132 Declaration also explains that increasing the showerhead electrode thickness increases the lifetime of the electrode, i.e., the number of RF hours that the electrode can be operated for without failing. The maximum amount of power that a showerhead electrode can be operated at without failing is dependent on its thickness. The relationship between showerhead electrode thickness and the power level applied to the electrode is plotted in the graph in Appendix B attached to the Rule 132 Declaration. The region above line A represents the experimentally determined operating range in which the probability of electrode cracking is low; the region below line A represents the operating range in which the probability of electrode cracking is high. Line A can be extrapolated to higher electrode thickness values to show that showerhead electrodes having a thickness of 0.30 inch or greater (which fall within the electrode thickness range of 0.3 to 0.5 inch recited in Claim 1) can be operated at significantly higher power levels than electrodes having a thickness of 0.25 inches or less, which thickness falls outside of the range recited in Claim 1. *See, In re Kollman*, 201 USPQ 193 (CCPA 1979).

In contrast, Degner fails to disclose or suggest that the electrode thickness is related to the amount of power that can be applied to the electrode without failure.

c. **Reduction of Byproduct Deposition Behind Electrode**

The Rule 132 Declaration further explains that increasing the showerhead electrode thickness increases the length of the gas passages and also increases the pressure behind the electrode. *See* page 12, lines 26-30 of the specification. The showerhead electrode having a thickness of 0.35 inch reduces backstreaming, i.e., the deposition of particle defects behind the electrode, as compared to the electrodes having a thickness of 0.15 inch, 0.18 inch, and 0.25 inch, which fall outside of the thickness range recited in Claim 1.

d. **Reduction of Electrical Resistance of Electrode**

The Rule 132 Declaration also explains that increasing the thickness of the showerhead electrode decreases its electrical resistance. As a result, ohmic losses in the electrode are reduced, and coupling of radio frequency (RF) power to the plasma reactor is enhanced. Reducing the impedance path of the RF provides for a higher etch rate of substrates in the plasma reactor at a set power level applied to the electrode. Surprisingly, the etch uniformity was as good as, or better than, a lower resistance electrode, e.g., a thinner electrode. Also, reducing the electrode resistance improves plasma confinement in the plasma reactor. *See* page 5, lines 2-8, of the specification.

Applicants respectfully submit that the evidence and arguments provided in the Rule 132 Declaration are sufficient to rebut the alleged *prima facie* case of obviousness. Accordingly, it is respectfully submitted that the subject matter recited in Claim 1 is patentable over Degner and Murai.

Claims 4-10 and 27-30 depend from Claim 1 and thus are also patentable over Degner and Murai for at least the same reasons that Claim 1 is patentable.

Claim 21, as amended, recites the combination of features recited in Claim 1 and, in addition, recites the feature of "a backing plate elastomer bonded to the electrode." Claim 21 is also patentable over Degner and Murai for at least the same reasons that Claim 1 is patentable.

Withdrawal of the rejection is therefore respectfully requested.

4. Rejection of Claim 3 Under 35 U.S.C. §103

Claim 3 stands rejected under 35 U.S.C. §103(a) over Degner in view of Murai, and further in view of U.S. Patent No. 5,993,597 to Saito et al. ("Saito"). The reasons for the rejection are stated at page 5 of the Official Action. The rejection is respectfully traversed for the following reasons.

Claim 3 recites the feature of "the gas outlets have diameters of 0.020 to 0.030 inch and the gas outlets are distributed across the exposed surface". It is acknowledged in the Official Action that Degner and Murai fail to disclose the diameter of the gas outlets as recited in Claim 3. However, it is asserted that Saito cures the deficiencies of Degner and Murai. Applicants respectfully disagree.

As explained in the Request for Reconsideration filed on March 17, 2003, Saito fails to disclose or suggest an electrode thickness of about 0.3 inch to 0.5 inch. In fact, Saito's electrode is thinner than a conventional 0.25 inch electrode. Thus, Saito teaches away from the combination of features recited in Claim 3, and thus provides no motivation to modify Degner's electrode to have the thickness recited in Claim 1. Therefore, dependent Claim 3

also is patentable over Degner, Murai and Saito for at least the same reasons that Claim 1 is patentable.

Withdrawal of the rejection is therefore respectfully requested.

5. Rejection of Claims 1, 4-10, 21, 23, 25, and 27-30 Under 35 U.S.C. §103

Claims 1, 4-10, 21, 23, 25, and 27-30 stand rejected under 35 U.S.C. §103(a) over Murai in view of Degner. The reasons for the rejection are stated at pages 5-8 of the Official Action. The rejection is respectfully traversed.

It is acknowledged in the Official Action that Murai fails to suggest an electrode having a thickness of about 0.3 to 0.5 inches, and that the silicon electrode is a showerhead. However, it is asserted that it would have been obvious to modify Murai's electrode in view of Degner to achieve the combination of features recited in Claim 1. Applicants respectfully disagree with these assertions.

Murai fails to disclose or suggest a showerhead electrode assembly. Degner, in contrast, discloses a *showerhead electrode assembly* 10, which has a substantially different construction than Murai's apparatus. As explained in the Request for Reconsideration filed on March 17, 2003, the asserted modification of Murai's apparatus requires substantial reconstruction and redesign of the apparatus and substantially changes its principle of operation. For at least this reason, the applied references do not render the claimed subject matter *prima facie* obvious.

Furthermore, modifying Murai's silicon electrode by increasing its thickness would still result in a silicon electrode that is *not* a showerhead electrode, and thus would not

achieve the claimed subject matter. Moreover, such showerhead electrode would be unsuitable for Murai's apparatus, which is not designed to utilize such electrode.

Also, the unexpected results presented in the Rule 132 Declaration that are achieved by the subject matter recited in Claim 1 rebut any alleged *prima facie* case of obviousness over Degner and Murai. Accordingly, it is respectfully submitted that Claim 1 also is patentable over Murai and Degner. Therefore, withdrawal of the rejection is respectfully requested.

Dependent Claims 4-10, 23, 25, and 27-30, and independent Claim 21, also are patentable over Murai and Degner for at least the same reasons that Claim 1 is patentable.

Withdrawal of the rejection is therefore respectfully requested.

6. Rejection of Claim 3 Under 35 U.S.C. §103

Claim 3 stands rejected under 35 U.S.C. §103(a) over Murai in view of Degner, and further in view of Saito. The reasons for the rejection are stated at pages 8-9 of the Official Action. The rejection is respectfully traversed for the following reasons.

Saito also provides no motivation to modify Murai's electrode to achieve the combination of features recited in Claim 1, including an electrode thickness of about 0.3 inch to 0.5 inch. Therefore, dependent Claim 3 also is patentable over Murai, Degner and Saito for at least the same reasons that Claim 1 is patentable.

Withdrawal of the rejection is therefore respectfully requested.

7. Rejection of Claims 1, 3-10, 21, 23, 25, and 27-30 Under 35 U.S.C. §103

Claims 1, 3-10, 21, 23, 25, and 27-30 stand rejected under 35 U.S.C. §103(a) over Saito in view of Degner. The reasons for the rejection are stated at pages 9-12 of the Official Action. The rejection is respectfully traversed for the following reasons.

As acknowledged in the Official Action, Saito does not suggest an electrode having a thickness of about 0.3 to 0.5 inches. Degner fails to suggest modifying Saito to provide a silicon electrode having both an electrical resistivity and thickness as recited in Claim 1. Thus, Claim 1 is patentable over Saito and Degner.

Dependent Claims 3-10, 23, 25, and 27-30, and independent Claim 21, also are patentable over the cited references for at least the same reasons that Claim 1 is patentable. Therefore, withdrawal of the rejection is respectfully requested.

8. Rejection of Claims 1, 3-10, 21, 23, 25, and 27-30 Under 35 U.S.C. §103

Claims 1, 3-10, 21, 23, 25 and 27-30 stand rejected under 35 U.S.C. § 103(a) over Degner in view of Saito. The reasons for the rejection are stated at pages 12-14 of the Official Action. The rejection is respectfully traversed for the following reasons.

Degner does not suggest an electrode having an electrical resistivity of less than 0.05 ohm-cm. Moreover, Degner also does not suggest the electrode thickness recited in Claim 1.

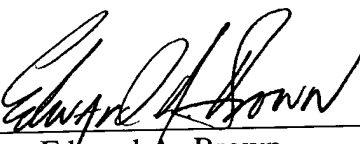
Saito does not suggest modifying Degner's electrode plate to provide a silicon electrode having both an electrical resistivity and thickness as recited in Claim 1. Thus, Claim 1 is patentable over Degner and Saito.

Dependent Claims 3-10, 23, 25, and 27-30, and independent Claim 21, also are patentable over the cited references for at least the same reasons that Claim 1 is patentable. Therefore, withdrawal of the rejection is respectfully requested.

For the foregoing reasons, withdrawal of the rejections and prompt allowance of the Application are respectfully requested.

Respectfully submitted,

BURNS, DOANE, SWECKER & MATHIS, L.L.P.

By: 
Edward A. Brown
Registration No. 35,033

P.O. Box 1404
Alexandria, Virginia 22313-1404
(703) 836-6620

Date: August 15, 2003